



Global epidemiology of tuberculosis, a comparative study of the six WHO regions in 2018

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Abstract

Introduction: Tuberculosis (TB) remains a global emergency and is one of the major threats to human and public health, more than 60 years of its medical treatment, as well as the economic and social development of societies. More than 2 billion individuals are infected with mycobacterium, causing the morbidity and mortality of 10 and 2 million individuals, respectively. The current study was accomplished aiming to investigate the TB disease status and indicators of achieving the goal of ending the TB epidemics by 2035.

Methods: This was a comparative study conducted in a library and the main source of information used included the reports published by the World Health Organization (WHO) and its regional organizations profile, the United Nations Development Program (UNDP), World Bank Group (WBG), and studies.

Results: The highest incidence rate was in Africa and South-East Asia, with the lowest incidence in the Americas and Europe regions. In the Eastern Mediterranean region, the incidence of extrapulmonary TB (EPTB) was about 10% higher than in other areas. The highest success rate of TB treatment was in the Western Pacific region and the lowest in the United States and Europe.

Conclusion: Over 1 billion US dollars have been spent in funding for the fight against TB. Health policymakers, especially in the Middle Eastern region, should pay particular attention to allocating national and local resources to this disease and rely less on international and humanitarian resources. In order to achieve the goal of ending the TB epidemic END-TB 2035, in addition to addressing the economic and social well-being of citizens, it is essential to focus on early detection and diagnosis of disease and effective treatment with strategy implementation [Directly Observed Treatment Short course (DOTS)].

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Introduction

Tuberculosis (TB) is the biggest cause of death from single-agent infectious diseases caused by mycobacterium TB. The disease is transmitted through respiration, and the patient disperses 3000 TB bacteria in each cough and infects more than 10 individuals each year.¹ More than one-third of the world's population is infected with mycobacterium TB, and the disease becomes

active in one in every 10 cases of infected individuals. About 10 million individuals experience active TB annually, and about 2 million people die from the disease.^{2,3} More than 95% of cases and deaths from TB occur in developing countries, countries where 75% of the cases is related to active age groups and the individuals supplying household income.³ Apart from economic damages and other negative indirect health impacts, there

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is another indirect negative outcome on the quality of life (QOL) of patients or their families. An adult with TB is not able to work for several months on average, and about 30% of the annual income of the family will be lost, moreover with the death of the individual, about 15 years of family income will be lost at the same time.⁴ TB has a negative economic and social impact on the QOL of patients and their families, including the exclusion of women and the abandonment of their children.^{3,5,6}

Poverty and severe class divisions in different societies are of the main reasons for the increased global burden of TB. TB and poverty are mutually linked in an evil cycle. The risk of TB infection and the activation of the disease in societies with lower socioeconomic status is higher due to living in more populated areas with more offspring and adverse environmental conditions.⁷ Furthermore, with increasing urbanization, the incidence of TB increases due to population density and high contact with people.^{6,8} By 2018, the incidence of TB was more than 140 per 100000 population and more than 10 million people were infected with TB worldwide (5.9 million men, 3.5 million women, and about 1 million children).⁹⁻¹¹ 60% of the new cases has occurred in 6 countries of India, Indonesia, China, Nigeria, Pakistan, and South Africa. More than 10% of the patients were infected with the human immunodeficiency virus (HIV). TB was the most important cause of death for patients with acquired immunodeficiency syndrome (AIDS).¹² TB

was one of the five main causes of death of women aged 15-44.^{4,13} Epidemiological studies are of great importance for the design of a comprehensive disease control program, and this study has been conducted on this basis. Therefore, this study was carried out with the aim to investigate and compare the status of TB indicators in the 6 World Health Organization (WHO) regional organizations in achieving the goal of ending TB epidemics.

Methods

The present study was a descriptive-analytic one conducted in a library and the main source used in the study was the reports published by the WHO and six regional offices in Africa, America, Eastern Mediterranean, Europe, Southeast Asia, and the West Pacific. In addition, reports from the United Nations Development Program (UNDP), the World Bank Group (WBG), as well as the studies were used. In this study, TB-related indicators, including the incidence of disease, death rates, and the success rate of treatment in the six WHO regions were reviewed.

Results

Table 1 lists the incidence of disease and reported cases, the percentage of AIDS testing at the time of diagnosis of TB, the percentage of cases of TB from all cases, as well as the percentage of positive pulmonary TB.

The results of table 1 showed that the incidence of TB was about 140/1000. In the six WHO regions, the highest incidence rate was associated with African-related illnesses and the lowest occurrence was for the United States.

Table 1. Tuberculosis (TB) case notification in 2016

WHO region	Estimates of incidence of TB in 2016		Total case notified	With known HIV status (%)	Pulmonary (%)	Bacteriology confirmed among patients with pulmonary TB (%)
	Rate	Number (thousands)				
African	254 (227-284)	2590 (2310-2900)	1303483	82	84	66
America	27 (26-29)	274 (255-294)	235535	80	84	78
East-Mediterranean	114 (86-174)	766 (573-985)	527693	16	76	53
European	32 (27-36)	290 (251-333)	297193	83	83	64
South-East Asia	240 (164-331)	4670 (3190-6440)	2900658	56	85	61
Western Pacific	95 (79-113)	1800 (1500-2130)	402336	56	85	61
Global	140 (118-164)	10400 (8770-12200)	6666898	57	85	57

WHO: World Health Organization; TB: Tuberculosis; HIV: Human immunodeficiency virus

Table 2. Treatment outcomes by tuberculosis (TB) case type in 2015 and MDR and XDR-TB in 2014

WHO region	XDR		MDR		New and recurrent cases	
	Success (%)	Number	Success (%)	Number	Success (%)	Number
African	27	623	59	16231	83	1200078
America	48	150	46	3344	76	204476
East-Mediterranean	42	81	65	3254	91	457855
European	29	4404	55	44394	77	218098
South-East Asia	29	1302	50	27227	78	2547781
Western Pacific	41	217	52	8453	92	1290677
Global	30	6777	54	102903	83	5918965

WHO: World Health Organization; MDR-TB: Multidrug-Resistant TB; XDR-TB: Extreme Drug Resistant-TB

A study on the simultaneous incidence of AIDS and the rapid diagnostic test at the beginning of treatment indicated the highest and lowest rates to be in the American region and the Eastern Mediterranean region, respectively. More than 80% of cases had pulmonary TB. Extra-pulmonary TB was higher in the Eastern Mediterranean region compared to other regions. Moreover, the highest and lowest cases of positive smear TB (definitive laboratory diagnosis) were respectively in the American region and in the Middle East region.

Table 2 shows the success rate of treatment for new and recurrent cases and cases resistant to TB treatment in the 6 WHO regions.

The results presented in table 2 showed that the success rate of TB treatment in the world in 2015 was more than 80%, with the highest and lowest success rates of TB treatment reported in the Western Pacific and American regions, respectively. In the six regions, the incidence rate of the disease was higher among men.

Table 3 illustrates the deaths from TB and co-infection with the AIDS virus in the six regions.

Data represented in table 3 showed that about 1.8 million deaths due to TB were reported (more than 20% of patients died) in 6 regions in 2016. About 5% of the patients were infected with the AIDS virus at the same time (about 400,000 individuals). The highest and lowest death rates were in Africa and the United States, respectively. The highest rate of death was due to the simultaneous onset of TB and AIDS in the African region.

Discussion

TB was declared by the WHO in 1993 as an emergency case and is still a global emergency. For the Millennium Development Goals (MDGs), the target of 50% reduction in TB outbreaks and death in 2015 compared to 1990 was for the countries which reduced TB prevalence by 40% and the death rate due to TB by 45% during this period. In order to achieve the goal of ending the TB epidemics, END-TB 2035, the incidence and death rate of cells decreased by 90% and 95%, respectively. The ultimate goal is to achieve an elimination stage of TB (less than one case per million) by 2050.

Table 3. Estimate of tuberculosis (TB) mortality in 2016

WHO region	Mortality (HIV-negative and positive)		Mortality (HIV-positive)		Mortality (HIV-negative)	
	Rate	Number (thousands)	Rate	Number (thousands)	Rate	Number (thousands)
	African	72.0 (64-81)	737 (655-824)	31.00 (27-36)	320.0 (272-372)	41.0 (34-48)
America	2.3 (2.2-2.4)	23 (22-24)	0.63 (0.56-0.70)	6.2 (5.6-6.9)	1.7 (1.6-1.8)	17 (16-18)
East-Mediterranean	13.0 (11-15)	85 (72-98)	0.45 (0.27-0.68)	3.0 (1.8-4.5)	12.0 (10-14)	82 (69-95)
European	3.4 (3.3-3.6)	31 (30-33)	0.55 (0.43-0.69)	5.1 (3.9-6.4)	2.8 (2.8-2.9)	26 (25-27)
South-East Asia	35.0 (30-41)	687 (576-807)	1.80 (1.3-2.40)	35.0 (25-46)	33.0 (28-40)	652 (542-772)
Western Pacific	5.7 (4.7-6.8)	108 (89-128)	0.26 (0.16-0.39)	5.0 (3.0-7.3)	5.4 (4.5-6.5)	103 (85-123)
Global	22.0 (21-24)	1670 (1530-1820)	5.00 (4.4-5.7)	374.0 (325-427)	17.0 (16-19)	1300 (1160-1440)

WHO: World Health Organization; HIV: Human immunodeficiency virus

Success in reducing the incidence and mortality rate of TB is influenced by several factors, including timely diagnosis of disease cases and appropriate treatment (Dots: Directly Observed Treatment). These two WHO indicators are known as the rate of detection of new cases by which the disease and the success rate of the treatment are identified. The global indicator of recovery expectation is 83%. The most successful treatment for TB was achieved in West Atlantic and the least successful treatment in the America and Europe regions, which could be due to various reasons such as lack of adherence of the patients to treatment and absence of treatment, poor follow-up of health workers, and poor evaluation of the treatment. Failure to complete the course of the disease leads to recurrence and MDR (Multi Drug Resistant-TB) and increases socioeconomic costs of the disease and also reduction of the rate of recovery. 102903 MDR-TB cases and 6777 XDR-TB cases have been reported worldwide.

The incidence of treatment-resistant cases was about 8 per 100000 populations, with the highest and the lowest rates respectively associated with the European region (13 cases) and the United States (1 case). In order to achieve WHO goals, activities that increase the detection and diagnosis early in the onset of clinical symptoms (since the patient spreads about 3,000 bacilli in each cough, infecting 10 to 15 other individuals per year) and effective treatment for patients are necessary. These activities include TB screening tests for high-risk groups (those around TB patients, prisoners, HIV+ individuals, dialysis and transplantation patients, camps and drug addiction clinics), and new diagnostic and treatment methods for TB control strategies. There are about 3.6 million unidentified TB cases in the world, requiring the participation and support of various governments and organizations, which needs about 1.3 billion dollars of fund to meet the TB goals. The estimated budget allocated to combat TB in the world is 498 million dollars, of which 19% has not been

allocated. Among the regions selected, the largest European budget was 1572 US dollars, more than 90% of which relied on local resources, and about only 2% of the total budget lacked the allocation of resources, followed by the United States and West Atlantic where 67% of the budget was based on domestic and local resources. The lowest budget allocated to combat TB was in the Middle East region (228 US dollars), of which only about 20% depended on local resources and more than 50% on international resources, and about 25% lacked resource allocation, requiring special attention of policymakers.

Conclusion

To reach the goal of ending TB and the TB-free world, great attention is needed from leaders and policymakers. Moreover, it is necessary to conduct TB screening tests for high-risk groups and diagnose patients in the early stages, in addition to discontinuing the transmission chain in a timely manner. Furthermore, treatment of patients under direct day-to-day supervision (Dots strategy) is required. The cooperation and participation of other institutions and organizations, especially in the context of the economic situation of the poor, support of the sick people, improvement of the status of prisons, camps and addiction treatment clinics, and paying attention and supporting health workers in anti-TB programs are the procedures required to overcome TB. TB and poverty are interconnected, and poor government support for poor communities by governments and nongovernmental organizations (NGOs) is an issue related to the executive implementation.

It is suggested that studies be conducted on patients' satisfaction, quality of service, treatment period, and complications of TB drugs, in order to be able to introduce methods with shorter treatment and better service delivery. It is also suggested that studies be conducted on the incidence of extra-pulmonary TB in the Eastern Mediterranean region, as compared to other areas.

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Authors' Contribution

All of the authors contributed equally.

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Conflict of Interest

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Ethical Approval

Not indicated.